REMARKS

Applicant appreciates the thorough review by the Examiner, and has amended claim 1 to remove the indefiniteness rejection under the provisions of 35 U.S.C. §112, second paragraph. Applicant has also amended claim 8 to remove the "and/or" language previously submitted.

The Examiner rejected claims 1 and 8 under the provisions of 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,888,631 to Eriksson (hereinafter "Eriksson" or "the Eriksson patent") in view of Japanese Serial No. JP-2001096241 (hereinafter " JP-2001096241"). Applicant respectfully requests reconsideration of the Examiner's rejections because Applicant respectfully submits that Raulins does not teach or suggest every element of the rejected claims.

Claim 1 includes the method elements of "providing a source of flushing fluid comprising ozone..." and then later flushing the surface to be cleaned "with said flushing fluid." The Examiner cites the Eriksson patent as teaching all the method steps except, that Eriksson does not utilize a fluid comprising ozone. Relying on a translation of the Abstract of JP-2001096241, the Examiner states JP-2001096241 discloses a method of removing organic material from a glass substrate by washing it with an ozone water solution. The Examiner then alleged that it would be obvious to one skilled in the art to combine the ozone water solution of JP-2001096241 with the teachings of Eriksson. Applicant respectfully submits that such a combination would not be obvious to one skilled in the art when the entirety of JP-2001096241 is reviewed.

Applicant submits herewith a translation of the description from the JPO website. According to the translation from the JPO website, the structures that are cleaned using the ozone water solution are immersed or soaked in the ozone water solution for a period of time, about five minutes as disclosed. *See* JP-2001096241 translation, paragraphs [0032] – [0048]. In each and every example, the object being cleaned was immersed into a solution, or soaking in a solution for a period of time of five minutes. In other words, the objects being cleaned were

subjected to prolonged and constantly sustained exposure to the cleaning liquid. There is no disclosure that the liquid would be suitable for cleaning by ejection from a nozzle, in which there is not prolonged and sustained exposure like soaking. Moreover, JP-2001096241 also does not disclose that the ozone water solution would be suitable for use within the harsh flow conditions in an oil extraction installation. Accordingly, Applicant respectfully submits that the Examiner has neither made a prima facie showing that one skilled in the art would recognize that the solution in JP-2001096241 could be used as alleged, nor shown that one skilled in the art would be motivated to use the soaking solution in JP-2001096241 with the Eriksson patent as alleged with an expectation of success when the solution is sprayed onto the surface rather than being immersed into. Therefore, Applicant respectfully submits that claims 1-8 are patentable over Eriksson and JP-2001096241, either alone or in combination, and respectfully requests that the Examiner remove the rejection based upon the Eriksson patent and JP-2001096241.

CONCLUSION

Applicant respectfully submits that remaining claims 1-8 are all in condition for allowance. Reconsideration of the application and allowance of all claims are respectfully requested, and Applicant respectfully requests the issuance of a Notice of Allowance.

Respectfully submitted,

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the penetrant remover and the washing approach for washing the precision substrate which consists of quartz glass, such as a quartz-glass substrate, a mask BURANKUSU substrate, a photo-mask substrate, a liquid crystal glass substrate, and an optical disk substrate.
[0002]
[Description of the Prior Art] In recent years, the demand to defecation of the photo-mask substrate used as a substrate for exposure is increasing increasingly with detailed-izing of the pattern dimension of a VLSI. A photo-mask substrate attaches metal thin films, such as chromium, to a quartz-glass substrate by vacuum evaporationo or the spatter, uses them as a mask BURANKUSU substrate, after it applies a resist etc. to this, it is exposed, it is etched, and forms a pattern in a front face. Therefore, in order to obtain a pure photo-mask substrate, what was defecated from the phase of a quartz-glass substrate and a mask BURANKUSU substrate is required. Advanced cleanliness is desired like [a liquid crystal glass substrate or an optical disk substrate] the photo-mask substrate.
[0003] In order to realize defecation, it is necessary to remove a pollutant, there is a scrub cleaning method which uses immersion type washing immersed in the immersion tub which held the penetrant remover in a substrate, the shower Ling's method which hangs a penetrant remover in a shower etc., sponge, etc. for the washing approach for it, and the approach which combined them further is adopted widely. Moreover, the approach of impressing a supersonic wave in that case and gathering washing effectiveness at it is also performed widely.
[0004] By the way, the sulfuric-acid filtered water, the ammonia filtered water, or the acid surfactant is used as a penetrant remover to remove washing of these precision substrates, especially an organic substance metallurgy group from the former. Since a substrate front face is melted although the cleaning effect of a sulfuric-acid filtered water or an ammonia filtered water is high, and it is a minute amount, ****** may be produced or display flatness may be spoiled. Therefore, there is a problem in the present condition that the demand of elaboration and densification is severe, using the sulfuric-acid filtered water and ammonia filtered water which are easy to be accompanied by quality degradation from now on. Moreover, when concentration change of these penetrant removers, management, cost, waste fluid processing, exhaust air, insurance, etc. are taken into consideration, there are many problems using these.
[0005] Although there is the approach of using an acid surfactant as the alternative, a surfactant may also change to environmental hormone and the problem of biodegradability is also pointed out. Moreover, although cost is reduced rather than a sulfuric-acid filtered water or an ammonia filtered water, when it sees synthetically, it is difficult [it / it is difficult to remove the particle which exists in the surface active agent of a ready-made article and a foreign matter, and / the cure of installation of a filter and always supervising at a particle counter is required, and] to carry out washing processing at cheap cost.
[0006] Although the sulfuric-acid filtered water, the ammonia filtered water, and the acid surfactant have been used for removal of the organic substance metallurgy group which exists in the front face of a precision substrate, the approach using ozone water or anode water (it may be hereafter called ozone water) as the substituting method, or in order to heighten a cleaning effect more, the solution which added acids, such as a hydrochloric acid, to this is advocated recently.
[0007] However, in order to use a hydrochloric acid, it is hard to corrode from a sulfuric-acid filtered water etc., but since there is possibility of foreign matter generating by the corrosion by the acid of cleaning equipment when prolonged use is taken into consideration, an acid-proof facility will be required and a periodical maintenance is also required. Although it becomes cheap, since it is necessary about a facility to apply cost, if a running cost is seen synthetically, it is the same than a sulfuric-acid filtered water etc. at the point which becomes an expensive facility.
[0008]
[Problem(s) to be Solved by the Invention] although use of ozone water is desirable when an environmental side is taken into consideration for washing of a precision substrate as mentioned

above -- ozone water -- if independent, since a facility acid-proof in a facility side is needed, there is a problem which becomes cost quantity with the ozone water which needed to make washing time amount long duration in order to meet the demand of high elaboration, and added the hydrochloric acid.
[0009] Then, it sets it as the main purpose that it has high washing capacity to pollutants, such as an organic substance metallurgy group, and does not need especially a corrosion resistance facility, but can mitigate an environmental load, and provides altitude with the penetrant remover and the washing approach of defecating easily in case this invention was made in view of the above troubles and washes a precision substrate.
[0010]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the penetrant remover of the precision substrate concerning this invention is a penetrant remover which washes a precision substrate, and is characterized by being the water solution which mixes ozone water, hydrogen water, or cathode water (it may be hereafter called hydrogen water), and changes.
[0011] According to the penetrant remover of the precision substrate of the above-mentioned configuration, as compared with the ozone water which added the hydrochloric acid, the washing capacity exceeding the washing capacity over the organic substance metallurgy group which is a pollutant can be demonstrated, the precision substrate defecated by altitude can be gained easily, and improvement in productivity and the yield can be aimed at. Moreover, there is especially no problem of waste fluid processing, and since an acid-proof facility is also still more unnecessary, it is possible to improve cost sharply.
[0012] In this case, the ozone level of ozone water is 5 ppm or more, and, as for hydrogen water, it is desirable that it is the hydrogen concentration of 0.5 ppm or more.
[0013] further -- this case -- an ozone level -- the ozone water and said hydrogen water concentration of 5 ppm or more -- the mixed rate (weight ratio) with hydrogen water 0.5 ppm or more -- 10:1 to 1000:1 -- it is 50:1 to 500:1 preferably.
[0014] Since ozone water has the high oxidation reduction potential (i.e., since there is oxidizing power), defecation is realizable by disassembling the organic substance or ionizing a metal. The ozone water containing a hydrochloric acid can explain the thing with a cleaning effect higher than an ozone water independent by the following formula in a metal (the following type is illustrated with copper).
Cu + H3 O+ -> Cu2+ + It is H3 O+ in H2 O, i.e., metaled ionization. It is required and it is given by the hydrogen ion of a hydrochloric acid. Hydrogen ion concentration is very low for the above-mentioned reaction, therefore a cleaning effect is [an ozone water independent] lower than the ozone water containing a hydrochloric acid.
[0015] When hydrogen water mixes ozone water, even if there is little hydrogen water, a pole part becomes a hydrogen ion and it is thought that it has contributed to washing.
[0016] However, since hydrogen water has reducing power, if an excessive amount is put in to ozone water, in order to make the oxidizing power of ozone water offset, if the rate of the mixed rate of ozone water and hydrogen water of hydrogen water increases more than 10:1, the cleaning effect of it is decreased or lost. Moreover, if the rate of hydrogen water has few rates of ozone water and hydrogen water than 1000:1, the amount of grants of a hydrogen ion will decrease, and the cleaning effect also of this will be decreased or lost.
[0017] Here, the washing approach of the precision substrate of this invention is the approach of washing a precision substrate using the penetrant remover of above-mentioned this invention. Thus, if the penetrant remover of this invention is used, a precision substrate can be washed efficiently and the precision substrate defecated by altitude can be obtained easily. Since an acid-proof facility is not required while being able to aim at sharp reduction of the load to an environment rather than the further conventional washing approach, it becomes improvable [washing cost].
[0018] And in the approach of washing a precision substrate with wet, the washing approach of the precision substrate concerning this invention prepares the water solution which mixes ozone water and hydrogen water and changes, and is characterized by washing a precision substrate using the penetrant remover containing this ozone and hydrogen.
[0019] According to such an approach, it is easy, the oxidizing power of ozone water can act

effectively to the organic substance metallurgy group which is a pollutant, and preparation of a penetrant remover can obtain the precision substrate extremely defecated by altitude. Furthermore, the cleaning equipment which performs the washing approach of this invention does not need especially a chemical-resistant facility. Moreover, since especially the waste water treatment of the penetrant remover after washing processing is not needed, either, there is also no problem of waste fluid processing. Therefore, while aiming at improvement in productivity and the yield, the improvement of quality improvement and cost can be aimed at.

[0020] In this case, it is desirable to impress a supersonic wave 0.8MHz or more to a penetrant remover, and to wash a precision substrate. In order to improve the washing capacity of the mixed penetrant remover of ozone water and hydrogen, a supersonic wave with a high frequency of 0.8MHz or more is effective, and can pull out big washing capacity using slight power cost.

[0021] And the precision substrate washed in this case can be used as a quartz-glass substrate, a mask BURANKUSU substrate, a photo-mask substrate, a liquid crystal glass substrate, and an optical disk substrate. The penetrant remover and the washing approach of this invention can act very effectively to these precision substrates, high washing capacity can be demonstrated, pollutants, such as the organic substance and a metal, can be removed, and the precision substrate defecated enough can be obtained. It seems that moreover, it is chemically stable, and these precision substrates are not corroded, or a substrate front face is adsorbed and it does not become a pollution source.

[0022]

[Embodiment of the Invention] Hereafter, although the gestalt of operation of this invention is explained to a detail, this invention is not limited to these. Although this invention persons have investigated and studied the penetrant remover and the washing approach in order to cope with the advanced request to the so-called defecation of precision substrates, such as a quartz-glass substrate, a mask BURANKUSU substrate, a photo-mask substrate, and a liquid crystal glass substrate, the penetrant remover which mixed ozone water and hydrogen water has very high washing capacity, and especially, they discern a header and terms and conditions for it being effective in washing of an organic substance metallurgy group etc., and removal, and complete this invention.

[0023] That is, although the sulfuric-acid filtered water, the ammonia filtered water, the acid surfactant, etc. have been used for removal of the organic substance metallurgy group which exists in the front face of a precision substrate from the former, when quality degradation of a substrate, increase of the load to an environment, the need for a corrosion-resistant facility, etc. are taken into consideration, use of the ozone water called the so-called functional water or hydrogen water is desirable.

[0024] Therefore, in the penetrant remover of the precision substrate by this invention, it is the penetrant remover which washes a precision substrate, and decided to use the water solution which mixes ozone water and hydrogen water and changes as a penetrant remover.

[0025] By carrying out like this, the oxidizing power of ozone water is heightened, a cleaning effect is raised more by hydrogen water, equivalent to the ozone water containing a hydrochloric acid to the organic substance metallurgy group which is a pollutant, or the precision substrate which demonstrated the washing capacity exceeding it and was defecated by altitude can be obtained, and improvement in productivity and the yield can be aimed at. Moreover, it is possible not to need waste fluid processing but to improve cost sharply by the needlessness of an acid-proof facility.

[0026] In this case, ozone water is 5 ppm or more of ozone levels, and the hydrogen concentration of 0.5 ppm or more is suitable for hydrogen water. It is enough to give the hydrogen ion which heightens the cleaning effect over the organic substance metallurgy group which is the pollutant of ozone water, if it is the liquid which dissolved 0.5 ppm or more of hydrogen, and if the concentration of ozone water is 5 ppm or more, the oxidizing power which oxidizes the above-mentioned pollutant is enough. Therefore, a precision substrate with high cleanliness can be obtained.

[0027] Furthermore, the ozone water and said hydrogen concentration of 5 ppm or more can set [an ozone level] a mixed rate with hydrogen water 0.5 ppm or more to 10:1 to 1000:1 in this case. And it is 50:1-500:1 still more preferably. If the mixed rate of the rate of hydrogen water of ozone water and hydrogen water increases more than (1) 10:1 when [this] out of range, there is reducing power of hydrogen water, if the effectiveness of the oxidizing power of ozone water is offset, a cleaning

effect is decreased or lost and there are few rates of hydrogen water than (2)1000:1, the amount of grants of a hydrogen ion will decrease, and the cleaning effect also of this will be decreased or lost.
[0028] As explained above, in washing of a precision substrate, the penetrant remover of this invention has high washing capacity, and it is excellent in washing of an organic substance metallurgy group etc. Therefore, according to the washing approach which uses the penetrant remover of this invention, a precision substrate can be washed efficiently and the precision substrate defecated by altitude can be obtained easily. Since excess capacity, such as an acid-proof facility, is not required while being able to aim at sharp reduction of the load to an environment rather than the further conventional washing approach, it becomes improvable [washing cost].
[0029] In the washing approach of this invention, it is desirable to impress a supersonic wave 0.8MHz or more to a penetrant remover, and to wash a precision substrate. The high frequency of 0.8MHz or more is effective in improving further the washing capacity of the mixed penetrant remover of ozone water and hydrogen water, and big washing capacity can be pulled out using slight power cost. This is because it is thought that it is effective also in contribution of a hydrogen ion while raising the cleaning effect by the high frequency.
[0030] And the precision substrate to wash can be used as a quartz-glass substrate, a mask BURANKUSU substrate, a photo-mask substrate, a liquid crystal glass substrate, and an optical disk substrate in adaptation of the penetrant remover of this invention, and the washing approach. The penetrant remover and the washing approach of this invention can act very effectively to these precision substrates, high washing capacity can be demonstrated, pollutants, such as the organic substance and a metal, can be removed, and the precision substrate defecated enough can be obtained. It seems that moreover, it is chemically stable, and these precision substrates are not corroded, or a substrate front face is adsorbed and it does not become contamination Hara. Therefore, this invention is suitable for washing of the above-mentioned substrate with which the defecation is demanded especially in recent years.
[0031] The approach which the soak cleaning method immersed in the immersion tub containing a penetrant remover in a well-known substrate, the shower Ling's method which hangs a penetrant remover in a shower etc., the approach which combined them further are mentioned from the former as a method which washes a precision substrate using the penetrant remover of this invention, and uses a supersonic wave together in that case is also effective. That is, the washing approach of this invention is not limited and can apply especially the washing method to any method.
[0032]
[Example] Although the example and the example of a comparison of this invention are given and being explained concretely hereafter, this invention is not limited to these.
[(Example 1) The cleaning effect over a quartz-glass substrate]
Left the quartz-glass substrate of a 6 inch angle with which cleanliness was secured for two weeks in the clean room, the organic substance etc. was made to adhere, and the contamination substrate was produced.
[0033] It was immersed in the penetrant remover which impressed the 1.0MHz supersonic wave in the immersion tub for 5 minutes, and this contamination substrate was washed. Temperature was performed at the room temperature. Under the present circumstances, a penetrant remover is a water solution which mixed ozone water of 8 ppm of ozone levels, and 1.8 ppm hydrogen water at a ratc of 100:1. And this penetrant remover was introduced from the pars basilaris ossis occipitalis of an immersion tub, and the contamination substrate was washed, making it overflow from the upper part.

[0034] Then, by spin desiccation, the substrate was dried and the foreign matter was measured by 200,000 luxs condensing inspection with the contact angle. Consequently, the foreign matter which existed in 113 piece / substrate before washing is decreasing sharply even to two piece / substrate. Moreover, the contact angle shows that what was 21.2 degrees has been improved to 4.2 degrees before washing, and contamination by the organic substance was removed. Washing conditions and a result were collectively indicated to Table 1.
[0035]
[Table 1]

項目 / 例No.	洗浄液の種類	オゾン水／水素水（－）	洗浄前 接触角（°）	洗浄前 異物数（個／基板）	洗浄後 接触角（°）	洗浄後 異物数（個／基板）
実施例1	オゾン水＋水素水	100／1	21.2	113	4.2	2
実施例2	オゾン水＋水素水	50／1	21.3	115	4.5	4
実施例3	オゾン水＋水素水	500／1	21.5	107	4.5	3
比較例1	オゾン水		21.3	109	8.7	13
比較例2	オゾン水＋塩酸		21.5	112	4.3	3

[0036] (Example 2) It washed by being immersed on the same conditions as an example 1 except having set the mixing ratio of ozone water and hydrogen water to 50:1. Washing conditions and a result were collectively written together to Table 1.
[0037] (Example 3) It washed by being immersed on the same conditions as an example 1 except having set the mixing ratio of ozone water and hydrogen water to 500:1. Washing conditions and a result were collectively written together to Table 1.
[0038] (Example 1 of a comparison) It washed by being immersed on the same conditions as an example 1 except having made hydrogen water nothing for the penetrant remover. Washing conditions and a result were collectively written together to Table 1.
[0039] (Example 2 of a comparison) It washed by being immersed on the same conditions as an example 1 except having added the hydrochloric acid by 8 ppm of ozone levels, having set the penetrant remover to pH3, and having made hydrogen water nothing. Washing conditions and a result were collectively written together to Table 1.
[0040] From Table 1, the ozone water + hydrogen water mixing penetrant remover of this invention has the cleaning effect also exceeding the ozone water independent twist of the example of a comparison, and can be equivalent to the ozone water containing a hydrochloric acid, or can have a cleaning effect beyond it, and can carry out washing removal of the pollutants, such as the organic substance and a metal, effectively.
[0041] [(Example 4) The cleaning effect over a photo-mask BURANKUSU substrate]
Left the photo-mask BURANKUSU substrate of the 6 inch angle which attached the CrON film with which cleanliness was secured for two weeks in the clean room, the organic substance etc. was made to adhere, and the contamination substrate was produced. It was immersed in the penetrant remover which impressed the 1.0MHz supersonic wave in the immersion tub for 5 minutes, and this contamination substrate was washed. Temperature was performed at the room temperature. Under the present circumstances, a penetrant remover is a water solution which mixed 8 ppm ozone water and 1.8 ppm hydrogen water at a rate of 100:1. And this penetrant remover was introduced from the pars basilaris ossis occipitalis of an immersion tub, and the contamination substrate was washed, making it overflow from the upper part.
[0042] Then, by spin desiccation, the substrate was dried and the number of foreign matters was measured by 200,000 luxs condensing inspection with the contact angle. Consequently, the foreign matter which existed in 135 piece / substrate before washing is decreasing sharply even to four piece / substrate. Moreover, the contact angle shows that what was 23.8 degrees has been improved to 5.1 degrees before washing, and contamination by the organic substance was removed. Washing conditions and a result were collectively indicated to Table 2.
[0043]
[Table 2]

項目 / 例No.	洗浄液の種類	洗浄前接触角（°）	洗浄前異物数（個／基板）	洗浄後接触角（°）	洗浄後異物数（個／基板）
実施例 4	オゾン水＋水素水	23．8	135	5．1	4
比較例 3	オゾン水	24．0	136	9．4	21
比較例 4	オゾン水＋塩酸	24．1	131	4．7	5

[0044] (Example 3 of a comparison) Hydrogen water was immersed on the same conditions as an example 4 except having made it nothing, and the penetrant remover was washed. Washing conditions were collectively written together to Table 2.
[0045] (Example 4 of a comparison) It washed by being immersed on the same conditions as an example 4 except having added the hydrochloric acid by 8 ppm of ozone levels, having set the penetrant remover to pH3, and having made hydrogen water nothing. Washing conditions and a result were collectively written together to Table 1.
[0046] From Table 2, the ozone water + hydrogen water mixing penetrant remover of this invention has the cleaning effect also exceeding the ozone water independent twist of the example of a comparison, and can be equivalent to the ozone water containing a hydrochloric acid, or can have a cleaning effect beyond it, and can carry out washing removal of the pollutants, such as the organic substance and a metal, effectively.
[0047] In addition, this invention is not limited to the above-mentioned operation gestalt. The above-mentioned operation gestalt is instantiation, and no matter it may be what thing which has the same configuration substantially with the technical thought indicated by the claim of this invention, and does the same operation effectiveness so, it is included by the technical range of this invention.
[0048] For example, although the above-mentioned operation gestalt illustrated and explained the case where a quartz-glass substrate and a photo-mask BURANKUSU substrate were washed, this invention is not limited to this but can be applied to it also to precision substrates, such as a photo-mask substrate, a liquid crystal glass substrate, and an optical disk substrate.
[0049]
[Effect of the Invention] If a precision substrate is washed using the penetrant remover which mixed the ozone water and hydrogen water of this invention as explained above A cleaning effect is higher than an ozone water independent cleaning effect to pollutants, such as an organic substance metallurgy group on a substrate front face. Moreover, equivalent to the cleaning effect of the ozone water containing a hydrochloric acid or the cleaning effect beyond it is acquired, and while being able to form the substrate front face where cleanliness is stable very high, improvement in productivity and the yield can be aimed at. Moreover, since ozone water and hydrogen water are used, acid resistance and a chemical-resistant facility become unnecessary, and since an environmental load can be reduced, the improvement of an installation cost or washing processing cost can be aimed at.

[Translation done.]